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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/845,356
Filing Date: May 01, 2001
Appellant(s): MISHIMA, MASAYUKI

Fang Liu
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed January 05, 2005 appealing from the Office action mailed May 05, 2004.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences (none) which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

This appeal involves claims 25-32.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is substantially correct. The summary indicates that claims 30-32 depend from claim 29, but claims 30-32 presently depend from claim 28. While a footnote to the summary indicates that claims 30-32 were previously inadvertently written to depend from claim 28, no amendment has been filed to correct the dependency of claims 30-32.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

A substantially correct copy of appealed claims 30-32 appears on page 27 of appellant's brief (the second page of the Claims Appendix). The minor errors are as follows: In line 1 of each of claims 30-32, "29" should read --28-- since each of claims 30-32 presently depend from claim 28.

The copy of appealed claims 25-29 contained in the Appendix is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

6,310,360	FORREST et al.	10-2001
5,294,810	EGUSA et al.	03-1994

Baldo, M.A. et al. "Very high-efficiency green organic light-emitting devices based on electrophosphorescence" Applied Physics Letters, Vol. 75, No. 1 (July 5, 1999), pp. 4-6.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

35 U.S.C. 103(a) rejection:

Claims 25-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in *Appl. Phys. Lett.* 75(1), pp. 4-6 (July 5, 1999) or Forrest et al. (US 6,310,360 B1), either reference in view of Egusa et al. (US 5,294,810).

Baldo et al. disclose light-emitting devices comprising a glass substrate, an anode, an organic compound layer including a light-emitting layer containing two light emitting materials, and a cathode. See the whole reference. In various devices, the light-emitting layer contains $Ir(ppy)_3$ and CBP. Baldo et al. also disclose a device in which the light-emitting layer contains $Ir(ppy)_3$ and Alq_3.

Forrest et al. disclose light-emitting devices comprising a glass substrate, an anode, an organic compound layer including a light-emitting layer/zone containing three light emitting materials, and a cathode. See the entire patent to Forrest et al. In particular, see Fig. 1, Fig. 3, column 9, line 1 - c. 11, l. 60, c. 12, l. 58 - c. 13, l. 50, c. 14, l. 63 - c. 15, l. 17 and c. 17, l. 9 - c. 19, l. 19. Note that c. 11, l. 57 contains an error in that λ for $Ir(ppy)_3$ should read --~500 nm-- rather than "~400 nm". In Forrest's Example 1, the light-emitting layer consists of an alternating series of layers of CBP doped with $Ir(ppy)_3$ and CBP doped with DCM2.

"CBP" stands for 4,4'-N,N'-dicarbazole-biphenyl, which is a blue light-emitting material having a light-emitting wavelength peak of about 400 nm.

"$Ir(ppy)_3$" stands for *fac* tris(2-phenylpyridine) iridium, which is a green light-emitting orthometallated complex of iridium having a light-emitting wavelength peak of about 500 nm.

"Alq_3" stands for tris-(8-hydroxyquinoline) aluminum, which is a green light-emitting material.

"DCM2" is the abbreviation for a pyran compound that is a red light-emitting compound having a light-emitting wavelength peak of about 590 nm (the full name is given at c. 4, l. 56-58 and the formula is shown at the bottom of c. 9 of the patent to Forrest et al.).

Baldo et al. or Forrest et al. disclose devices comprising more than one light-emitting material, each of the materials capable of emitting light of a different color, wherein one of the materials is an orthometallated complex. In Baldo's device comprising CBP doped with $Ir(ppy)_3$, a single light-emitting layer contains green and blue light-emitting materials. In Forrest's device of Example 1, green and blue-light emitting materials are contained in one light-

emitting layer while red and blue-light emitting materials are contained in a second light-emitting layer.

The prior art devices of Baldo et al. or Forrest et al. do not comprise red, green and blue light-emitting materials mixed in a single layer as required by claim 25, with claims 26-28 and 30-32 dependent directly or indirectly therefrom, and do not comprise separate red, green and blue light emitting layers as required by claim 29. The prior art devices of Baldo et al. or Forrest et al. do not emit white light as required by the present claims.

Further, in the devices of Baldo et al. or Forrest et al., the light-emitting layer(s) only comprise(s) one orthometallated complex rather than at least two as required by present claims 26 and 30, or at least three as required by present claims 27 and 31.

It was known in the art at the time of the invention that the color of light emitted by a light-emitting device can be controlled by the selection of light-emitting materials used in the device, and that emission of white light can be achieved by providing an appropriate combination of light-emitting materials.

Egusa et al. disclose light-emitting devices, teach that a light-emitting device may comprise more than one light-emitting layer (e.g. see column 11, line 40 - c. 12, l. 60 and c. 19, l. 52 - c. 20, l. 61), teach that different light-emitting materials may be mixed in a light-emitting layer in order to control light-emission wavelength and that the mixture may include a phosphorescent material emitting light from a triplet excited state (e.g. see c. 25, l. 36 - c. 27, l. 15), and teach that it is possible to achieve emission of white light from a device comprising

multiple light-emitting layers and from a device comprising a mixture of light-emitting materials (e.g. see c. 20, l. 57-61 and c. 26, l. 15-28).

It would have been an obvious modification to one of ordinary skill in the art at the time of the invention to provide light-emitting devices similar to those disclosed by Baldo et al. or Forrest et al. but utilizing different and/or additional light-emitting materials in combination with the iridium complex either in the same layer or in a light-emitting layer separate from the layer comprising the iridium complex. One of ordinary skill in the art would have been motivated to utilize different and/or additional light-emitting materials in combination with the iridium complex so as to provide a device having the advantages of using a phosphorescent material as taught by Baldo et al. or Forrest et al. while at the same time being able to modify the color of light emitted by the device as taught by Egusa et al. It would have been within the level of ordinary skill of a worker in the art at the time of the invention, as a matter of routine experimentation, to determine suitable and optimum combinations of light-emitting materials selected from known light-emitting materials so as to obtain a functional device capable of emitting light of the color(s) desired. One of ordinary skill in the art would have been motivated to select a combination of light-emitting materials capable of providing white light when the light-emitting device was intended to be used for an application where white light was desirable.

With respect to claim 28, with claims 30-32 dependent therefrom, one of ordinary skill in the art at the time of the invention would have recognized that in order to provide a white light emitting device as taught by Egusa et al., a device would have to be provided with two or more

light-emitting materials that emit light when an electric field is applied across the electrodes of the device.

With respect to the requirement for more than one orthometallated complexes as in claims 26, 27, 30 and 31, Baldo et al. or Forrest et al. disclose an orthometallated complex that is a green light-emitting material, and orthometallated complexes that emit blue or that emit red are known. The selection of suitable and optimum combinations of red, green and blue light-emitting materials from known materials in order to achieve white light would have been within the level of ordinary skill of a worker in the art at the time of the invention as a matter of routine experimentation.

(10) Response to Argument

35 U.S.C. 103(a):

Appellant argues that that there is no motivation to combine either of the primary references with the secondary reference or, even if there might be motivation to combine the references, the combinations would not result in the presently claimed white light-emitting device.

Appellant argues that the primary references do not disclose or suggest multiple light-emitting materials in the same or different layer as the layer comprising the iridium complex. This argument is not persuasive as each of the primary references clearly discloses at least two light-emitting materials per device, one of the light-emitting materials being an iridium complex.

Each of the primary references and the secondary reference pertains to organic EL devices and each discloses that multiple light-emitting materials may be used in combination in an organic EL device. The primary references establish that an orthometallated complex as required by the present claims was known in the art at the time of the invention to be a suitable light-emitting material for an organic EL device. The secondary reference establishes that it was known in the art at the time of the invention that organic EL devices that emit white light can be obtained by selecting an appropriate combination of light-emitting materials, including combinations of red, green and blue light-emitting materials. The secondary reference also establishes that it was known in the art at the time of the invention that materials exhibiting phosphorescent emission can be used in a mixture of light-emitting materials when making an organic EL device. The orthometallated complex used in the primary references exhibits phosphorescent emission.

The secondary reference provides motivation to use red, green and blue light-emitting materials in order to provide a device capable of emitting white light, and either of the primary references provides motivation to use an orthometallated complex as a light-emitting material. It is the examiner's position that the motivation to combine the references lies in the advantages to be attained by the use of an orthometallated iridium complex as taught by either primary reference while being able to modify the color of light emitted from the device as taught by the secondary reference.

Appellant argues that even if the primary references are capable of being modified to result in the presently claimed invention, there is no teaching, motivation or suggestion in the prior art to make the modification. Appellant questions why one of ordinary skill in the art would be motivated to include different and/or additional light-emitting materials in Baldo's or Forrest's devices in order to modify the color of light emitted by the devices while providing the advantage of using a phosphorescent material. Appellant's query answers itself. Advantages of using a phosphorescent material are taught by Baldo and Forrest. One of ordinary skill in the art at the time of the invention would have readily recognized the value of devices emitting colors other than those specifically taught by Baldo and Forrest, and the fundamental concept of altering the color of emitted light by providing combinations of different light-emitting materials was known in the art at the time of the invention as evidenced by the teachings of Egusa et al. One of ordinary skill in the art at the time of the invention would have been motivated to retain the advantages obtained by using a phosphorescent material as taught by either primary reference while having the capability of achieving different light-emission colors, such as the capability to provide a device emitting white light.

Appellant further argues that while Egusa et al. disclose controlling the light-emission intensities of red, green and blue, Egusa et al. but do not expressly teach red, green and blue light-emitting materials. This argument is not well taken. One of ordinary skill in the art at the time of the invention would readily presume and recognize that red, green and blue light-emission (and thus, red, green and blue light-emission intensities) could be obtained from red, green and blue light-emitting materials, respectively.

With respect to the rejection based on Baldo et al. as the primary reference, appellant further argues that Baldo's use of CBP militates against the use of CBP as a blue light-emitting material since Baldo et al. use CBP to transfer energy to the iridium complex. This argument is not persuasive because the present claim language is open and does not exclude the presence of more than three materials in the light emitting layer(s). One motivated to provide a white light emitting device having advantages obtained by the use of a phosphorescent material would merely have to select appropriate additional light-emitting materials to be combined with the materials used by Baldo et al. While the blue light-emission provided by CBP in Baldo's device is minimal, one of ordinary skill in the art at the time of the invention would be motivated to add, for example, an additional material capable of emitting blue light and an additional material capable of emitting red light in sufficient relative quantities to control the light-emission intensities of the various light-emitting materials in the device so as to provide white light emission.

With respect to the rejection based on Baldo et al., appellant's footnote on page 15 of the brief is not understood. The footnote does not appear to relate to an argument made by the examiner. Further, appellant's footnote appears to suggest that adding a red light-emitting material to a material emitting green and blue would not (could not?) achieve white light emission. This suggestion is confusing since red, green and blue light-emission must be combined to provide white light-emission according to the presently claimed device.

With respect to the rejection based on Forrest et al. as the primary reference, appellant argues that the iridium complex $Ir(ppy)_3$ as used by Forrest et al. is contrary to the use of the

iridium complex as a red light-emitting material because Forrest et al. use the iridium complex to enhance the efficiency of emission by DCM2. The examiner notes that $Ir(ppy)_3$ is a green light-emitting material rather than a red light-emitting material as suggested by appellant. Appellant's argument is also not persuasive because the present claim language is open and does not exclude the presence of more than three materials in the light emitting layer(s). One motivated to provide a white light emitting device having advantages obtained by the use of a phosphorescent material would merely have to select appropriate additional light-emitting materials to be combined with the materials used by Forrest et al. While the green light-emission provided by $Ir(ppy)_3$ in Forrest's device is less than the red light-emission provided by DCM2, one of ordinary skill in the art at the time of the invention would be motivated to add, for example, an additional material capable of emitting blue light and an additional material capable of emitting green light in sufficient relative quantities to control the light-emission intensities of the various light-emitting materials in the device so as to provide white light emission.

Appellant further argues that modifying the devices taught by either primary reference in the manner proposed by the examiner would render the devices unsatisfactory for their intended purpose. The examiner respectfully disagrees. Modification to alter the color of light would not render the devices unsuitable for light emission.

Appellant further indicates that the selection of suitable and optimum combinations of red, green and blue light-emitting materials is not something which could be carried out routinely by persons of ordinary skill in the art. The examiner notes that the various light-emitting materials suggested for use by the present specification are known materials. The examiner also

notes that there are only four working examples in the present specification, none of which meet the limitations of present claims 27 and 31. If appropriate combinations of red, green and blue light-emitting materials cannot be selected from known materials with routine experimentation, then one might question the scope of enablement for the present claims given the minimal guidance provided by the present specification.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Marie R. Yamnitzky

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PRIMARY EXAMINER
1774

Marie R. Yamnitzky
February 14, 2005

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